GRS
TYPE B CROSSING GATE MECHANISM

TOOLS FOR TRANSPORTATION

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GRS DEVELOPMENT SHEET

Typical installation of GRS crossing gate.

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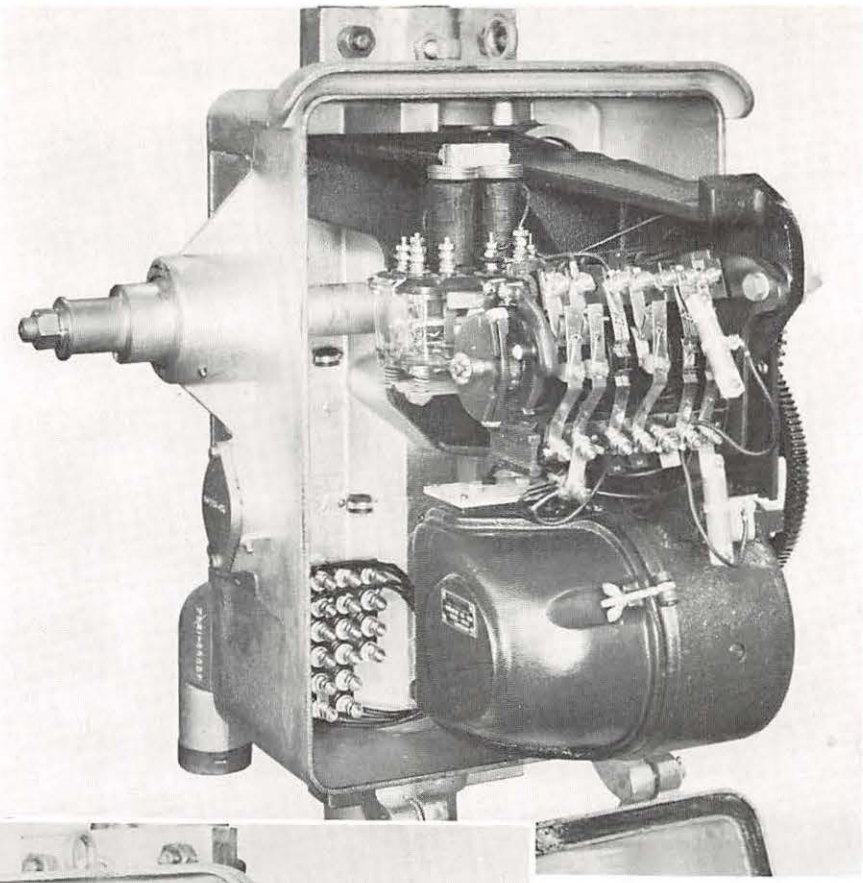
Figure 1.



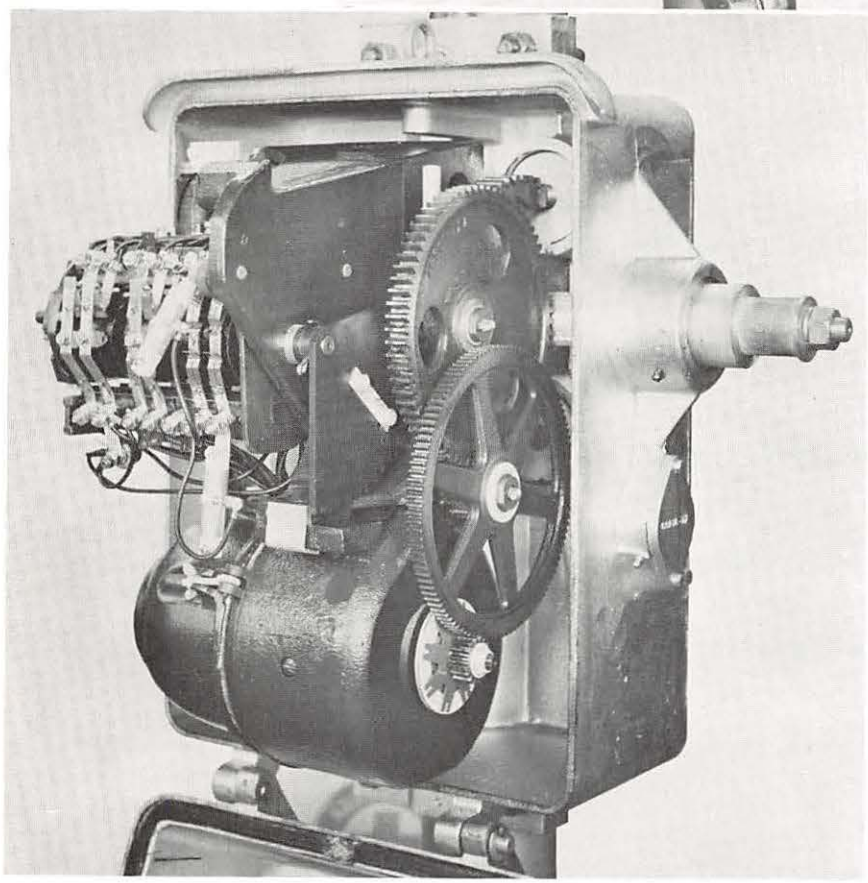


Figure 2.

Views of highway crossing gate mechanism.

TYPE B CROSSING GATE MECHANISM

The Type B crossing gate mechanism is designed to operate roadway gate arms up to 40 feet in length. It can be equipped with a sidewalk arm.

Figures 1 and 2 show that the mechanism and gate arm shaft are in a single housing, which is clamped to a 5-inch mast.

The mechanism is designed for low-voltage d-c operation. (See Battery, page 19). The gate arm is raised from the horizontal (0°) to the vertical (90°) position by means of the motor and gear train. It is held in the vertical position by a ratchet and pawl for as long a time as the hold-clear magnet is energized.

When the hold-clear is deenergized, the gate arm lowers by gravity, assisted by power from 90° to 45°, and retarded by dynamic braking from 45° to 0°.

The gate arm shaft, Figure 3, is two inches in diameter. It is supported in ball bearings and is splined to receive the main driving sector gear and gate grip arms.

If a sidewalk arm is used, the mechanism is supplied with a square sectioned shaft which extends through only one side of the mechanism case.

The gearing, motor, and circuit controller can be removed from the housing without disturbing the gate arm shaft.

Housing

The housing, Figure 3, is held securely on the mast by two U-bolts. A clamp is fastened to the mast directly below the lower U-bolt. This clamp holds the housing in place on the mast when the U-bolt nuts are loosened to permit the housing to be turned away from the highway during installation, adjustments, or replacement of arms.

The regular wire inlet to the mechanism is by means of 2-inch flexible metallic conduit extending from a fitting on the back of the housing to a suitable fitting on the junction box clamp base.

Cover

Hinge lugs on the cover, Figure 3, are drilled to fit grooved pins driven into hinge lugs on the case. You can remove the cover by extracting a cotter pin from the right-hand hinge pin. Cover is secured by an adjustable latch. Latch is made adjustable to obtain proper compression of the packing. Handle can be padlocked.

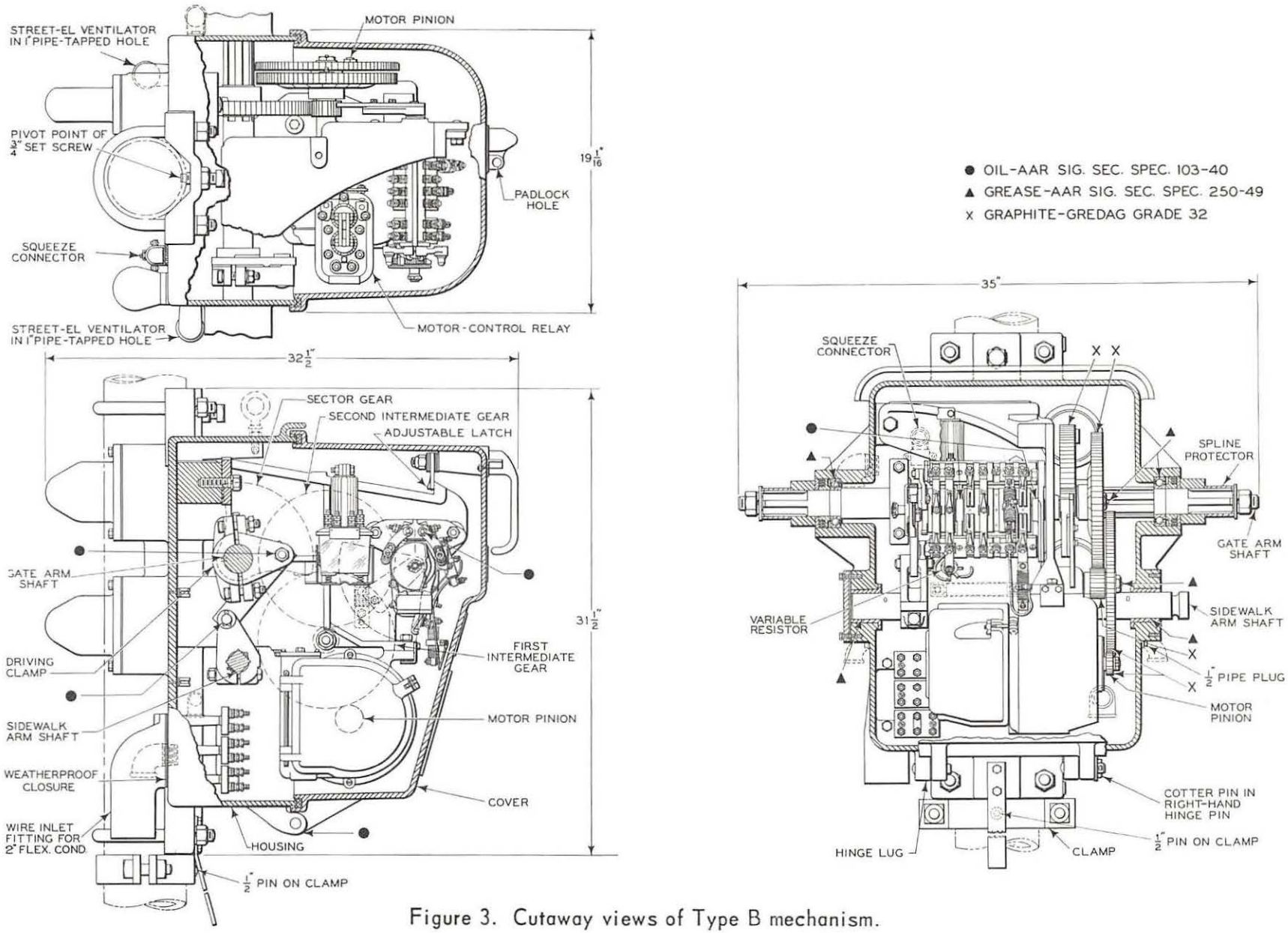


Figure 3. Cutaway views of Type B mechanism.

Motor

The motor, Figure 4, is four-pole d-c, with six field windings. When gates are raised, the motor is series connected with the four up-field windings in series-multiple, as shown in Figure 12. When gates are lowered, a modified compound motor connection using the two down-field windings in series (power down) is employed to ensure positive descent of roadway arm against adverse wind.

Spring-Coupled Hold-Clear

The hold-clear is spring-coupled to prevent excessive strain on the mechanism when the gate arm settles back in the clear position.

With armature 10 picked up, tip of dog 5 engages tooth on hold-clear disc 9. This holds the gate up in the 90° or "clear" position.

NOTE: The hold-clear is factory adjusted and no readjustment should be attempted unless proper equipment is available for maintaining the following clearances:

1. Clearance between nut 7 and bushing 8 . . . . . 0.008 to 0.012 inch.
   Adjust by turning nut 7.
2. Clearance between tip of dog 5 and bottom of tooth on hold-clear disc 9. . . . . 0.008 to 0.012 inch.
   Adjust by moving hanger block 4 by screws 3.

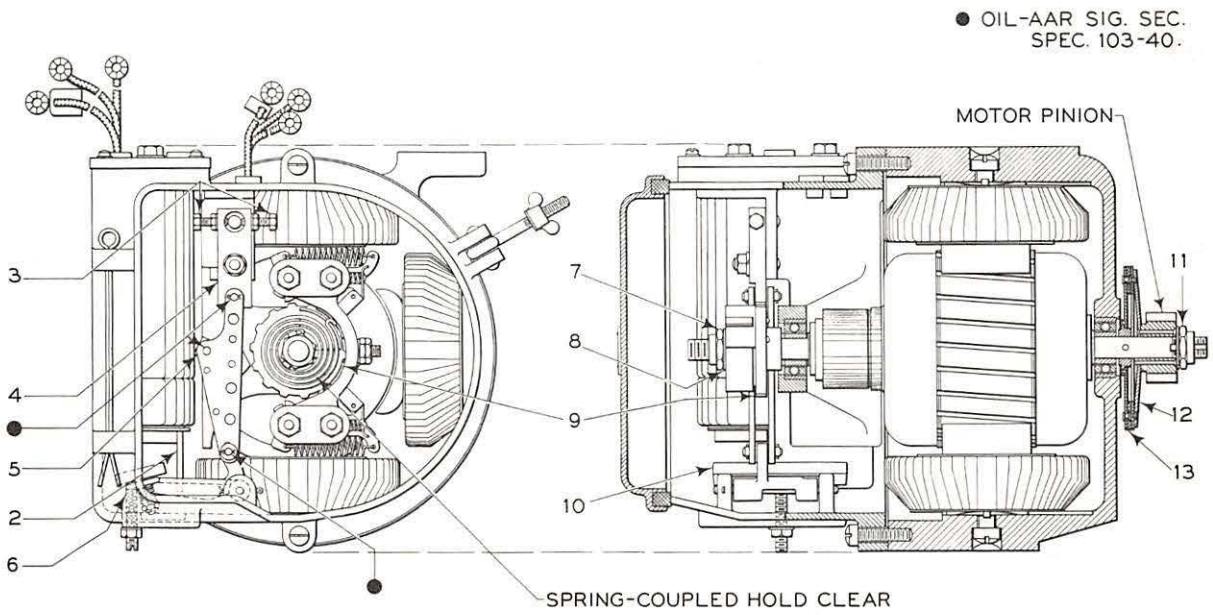


Figure 4. Direct-current motor.

3. Clearance between tip of dog 5 and teeth of disc 9, with armature 10 released. . . . . 0.020 to 0.025 inch. Adjust with stop 6.
4. Dropaway voltage of the hold-clear magnet (new) is not less than 3.25 volts nor more than 5.5 volts, with 1-1/2 foot-pounds torque on the motor shaft. Dropaway voltage in the field should not be less than 2.5 volts. The dropaway voltage can be increased or decreased by adding or removing shim washers from the top of each magnet core. If the dropaway voltage is too low, a 0.005-inch washer should be placed on each core in addition to the 0.010-inch washer already there. If the dropaway voltage is too high, the 0.010-inch washer on each core should be removed and replaced with a 0.005-inch washer.

Motor-Control Relay

Above the motor is a Type K2 motor-control relay. Contacts of the motor-control relay select the direction of rotation of the motor by proper circuit connections and also complete the snub circuit.

After the gate mechanism is completely erected and ready for service, the metal strap fastened to the relay core structure and secured to the mechanism frame should be removed. This strap is used only for holding the relay during shipment. The cardboard protectors alongside the relay should also be removed.

It is important that the voltage across the coils of the motor-control relay be adjusted to and maintained at four volts, when the gate is in the clear position. A variable resistance unit, assembled on circuit controller contact 4, provides a way to adjust and maintain this specified voltage. After the normal operating voltage at the gate has operated the gate to the clear position, a voltmeter should be placed across the relay coils and the voltage measured. If the voltage is not as specified, the locking nut on the adjusting shaft of the variable resistor should be loosened and the shaft turned in the direction which adjusts the voltage to four volts. After the adjustment, the locking nut should be securely tightened on the shaft.

Friction Driving Clutch

Friction driving clutch 13, Figure 4, on the pinion end of the motor shaft prevents strain on the motor and mechanism should the gate arm be broken off and the gears driven by counterweights against the 90° stop. With the pinion blocked, the clutch should be adjusted to slip at motor current of 14

amperes. The clutch is adjusted by turning nut 11 to increase or decrease compression on spring 12. This is factory adjusted and rarely needs re-adjustment.

Gear Train

The motor pinion, Figure 3, drives the first intermediate gear which in turn drives the second intermediate gear which then drives the main sector gear on the gate arm shaft. Total gear reduction is 218:1 between motor shaft and gate shaft.

Circuit Controller

In mesh with the small pinion of the second intermediate, a second sector gear drives the circuit controller. The controller, Figure 5, has fourteen contact spaces. Six of these are for control of the gate mechanism. The rest can be used for auxiliary circuits such as bells, gate lamps, and indicator lights. Even numbered contacts are on the side of the controller nearest the mechanism cover. Odd numbered contacts are on the side of the controller nearest the mast.

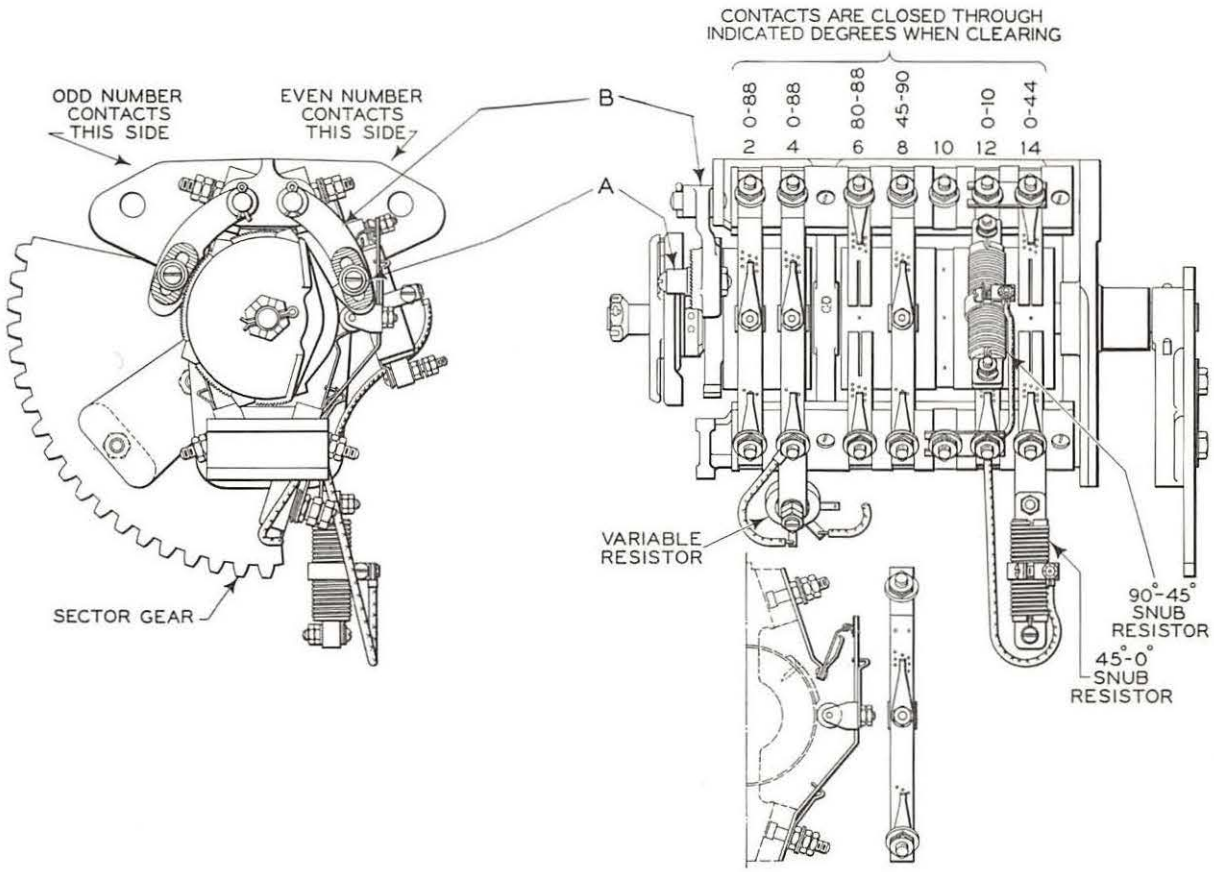


Figure 5. Circuit controller.

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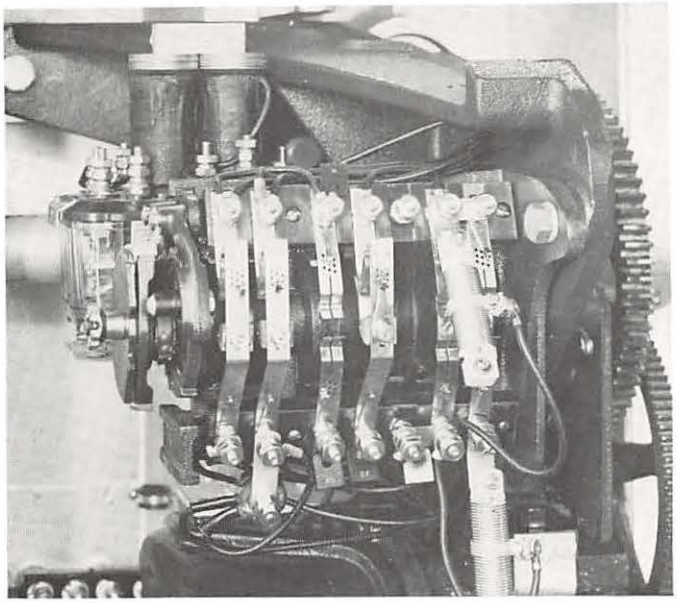

Circuit controller.

Circuit Controller Operation and Functions

0° = gate horizontal - blocking highway

90° = gate vertical - clearing highway

Contact Space No.	Clearing 0° ⟶ 90° Closes	Clearing 0° ⟶ 90° Opens	Blocking 90° ⟶ 0° Closes	Blocking 90° ⟶ 0° Opens	Function of Contact
1	75°	-	-	75°	Gate Repeater Relay (GPXR)
2	-	88°	75°	-	Up Motor Cutout
3	-	-	-	-	Spare Space
4	-	88°	75°	-	Motor Control Relay Cutout
5	-	85°	85°	-	Flasher Relay Control
6	80°	88°	88°	80°	Hold-clear Control
7	-	85°	85°	-	Light Control
8	45°	-	-	45°	Down Motor Cutout
9	3°	-	-	3°	Bell Control
10	-	-	-	-	Spare Space
11	87°	-	-	87°	Indication Light
12	-	10°	10°	-	Snubbing Resistor Shunt
13	-	3°	3°	-	Indication Light
14	-	44°	44°	-	0° - 44° Snubbing Contact

TYPE B CROSSING GATE MECHANISM

Motor Cutout

If the gate arm is not driven high enough, move knob A, on arm B, Figure 5, down until correct gate-clear position is obtained.

Descending Time

Power for driving down is cut off at 45°, and the gate descends to horizontal (0°) by gravity. From 45° to 0° the snub resistor attached to the lower binding post in space 14 on the controller, Figure 5, is cut in across the armature and up-field windings. The total descending time of the gate arm can be regulated by adjusting the snub resistor attached to the upper binding post in space 12 (power-down adjustment) and the snub resistor attached to the lower binding post in space 14 (gravity-down adjustment) as follows:

90°⟶45° Power-down adjustment, space 12

To drive gate down faster, move adjustable strap down.

45°⟶0° Gravity-down adjustment, space 14

To cause gate to lower faster, move adjustable strap down.

Mechanisms leave the factory with the descending time set for 10 to 12 seconds at 14 volts, based on a gate arm length of 28 feet.

Clearing Time

The gate should clear from 0° to 90° in 8 to 12 seconds, with energy supplied according to table on page 18.

Gate Arm Length (Feet)	Clearing Time (Seconds)
up to 24	8
25 to 36	8 to 10
37 to 40	10 to 12

Mechanism is factory adjusted to clear a 28 foot gate arm in 9 seconds at 14 volts.

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Stops

Adjustable spring stops are provided for 0° and 90°, as shown in Figure 6, and are protected by covers. The sector comes in contact with a stop at the 0° position only. The 90° stop should be adjusted so there is approximately 1/8-inch clearance between the sector and the stop when the gate is in the 90° position. (This allows 3° overrun of gate). For horizontal adjustment, loosen lock nut B, insert a 3/8-inch round bar in the hole in the end of adjusting screw A, adjust for 0° position, and retighten lock nut B, holding buffer nut C. Spring D has already been given 5/8-inch compression in the factory. For vertical adjustment, loosen lock nut G, adjust screw F with 3/8-inch round bar, retighten nut G, holding buffer nut H. Spring J has already been given a 3/16-inch compression in the factory. Raise and lower gate by power to check.

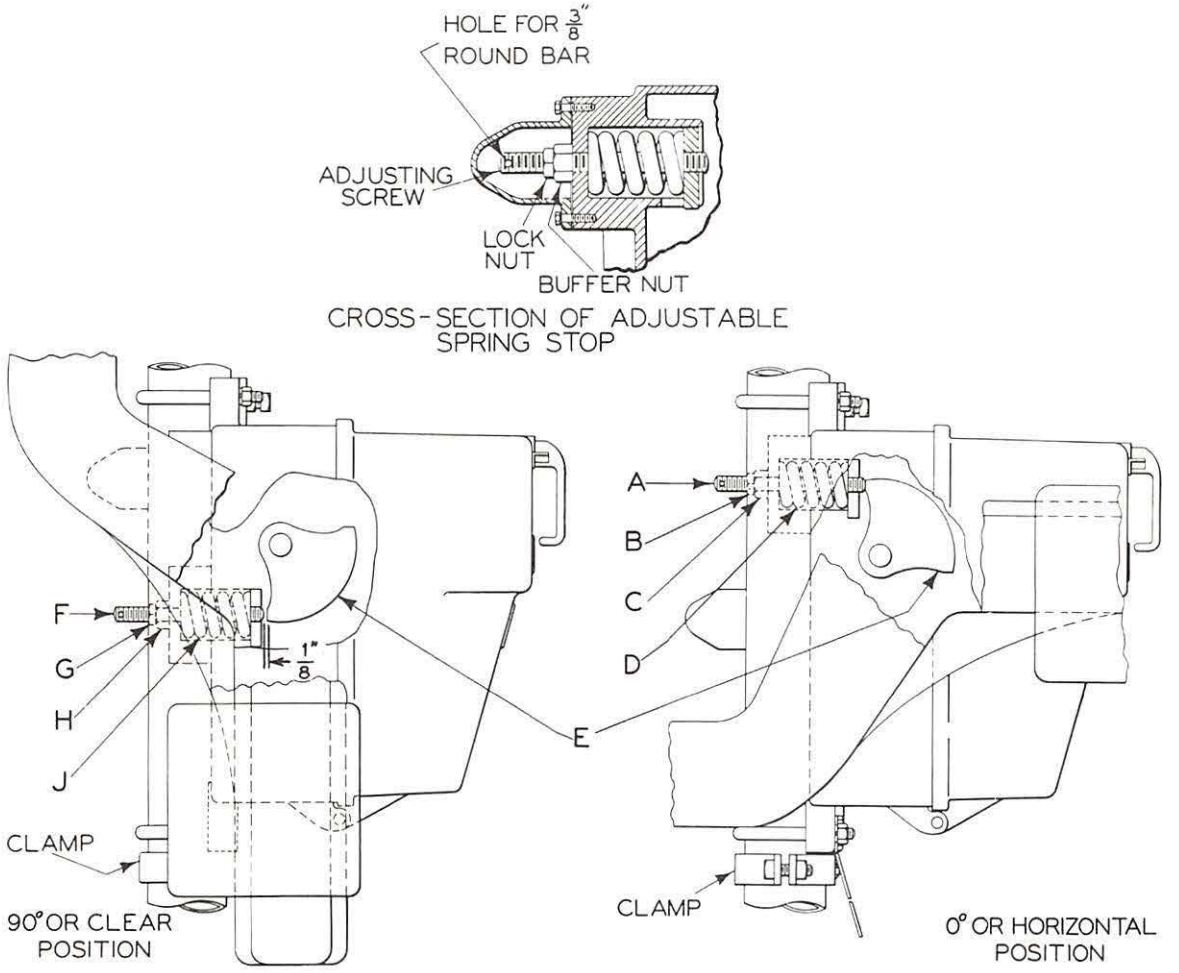

Figure 6. Stop adjustment.

Counterweights

To counterweight the roadway arms, weights are attached to grip arms R and L as shown in Figure 7. If the gate arm is 25 to 30 feet long, 160-pound weights are attached to both grip arms, R and L. With gate arms 31 to 40 feet long, weights are attached to channel extension arms which are bolted on grip arms R and L, Figure 7. These weights are secured as in Figure 8 and clamped in place to give the required torque of 50 foot-pounds in the horizontal position, as shown in Figure 9. Additional weights of 25, 50, 100, and 200 pounds can be bolted on the 160-pound weights if necessary to obtain the proper torque for a particular length of gate arm. See table, page 18. With gate arms not more than 24 feet long, only one grip arm, R, is used with 160-pound weight combinations. Stub grip L in this case is a different casting which is rounded off just beyond its point of attachment to the main shaft. See lower illustration in Figure 9.

As shown in Figure 10, the weights are also adjusted to provide the proper torque with the gate at 90 degrees. A complete table of torque values is shown on page 18.

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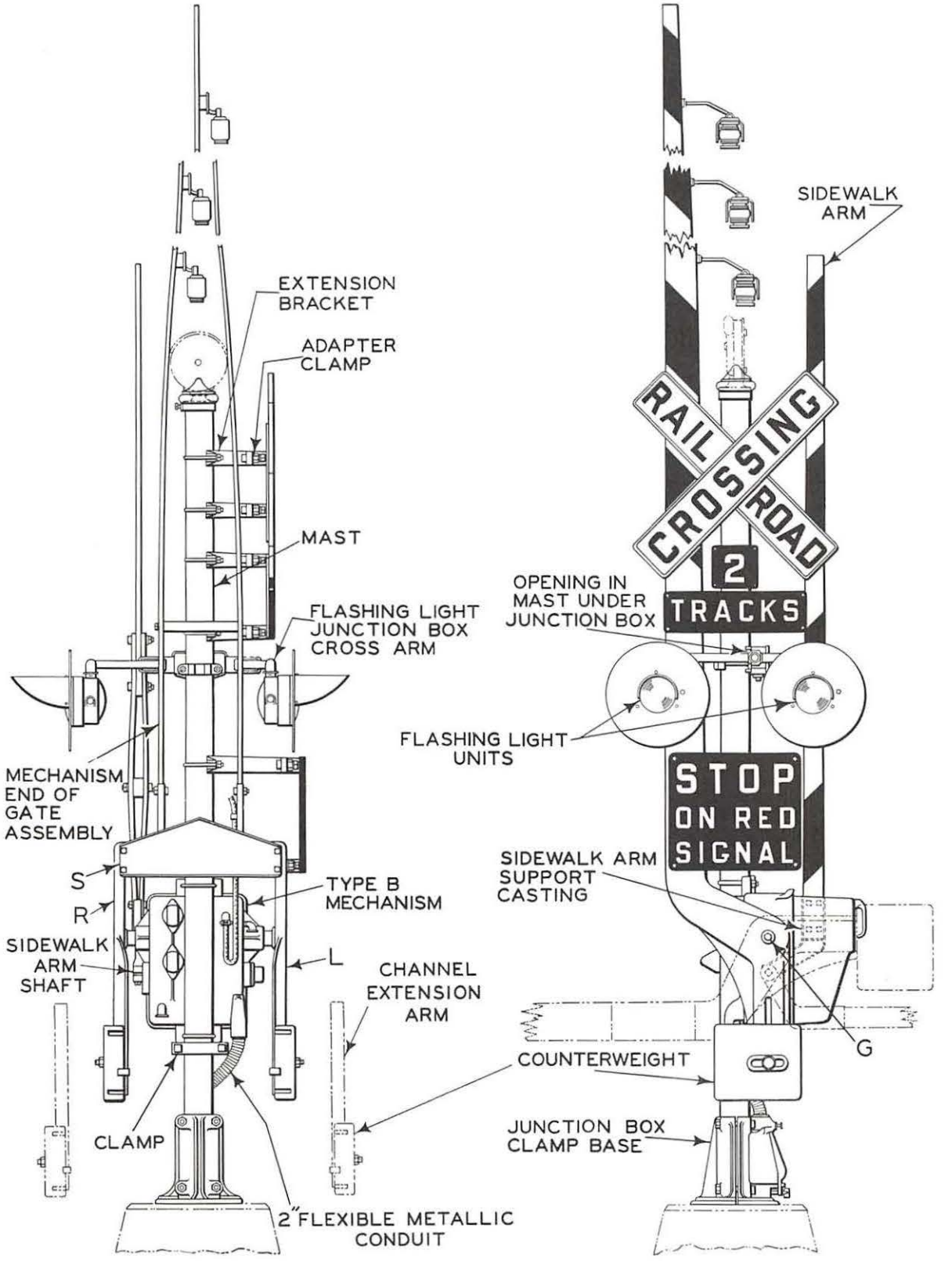

Figure 7. Typical installation with gate arm over 24 feet long, and with sidewalk arm. Note two counterweights.

TYPE B CROSSING GATE MECHANISM

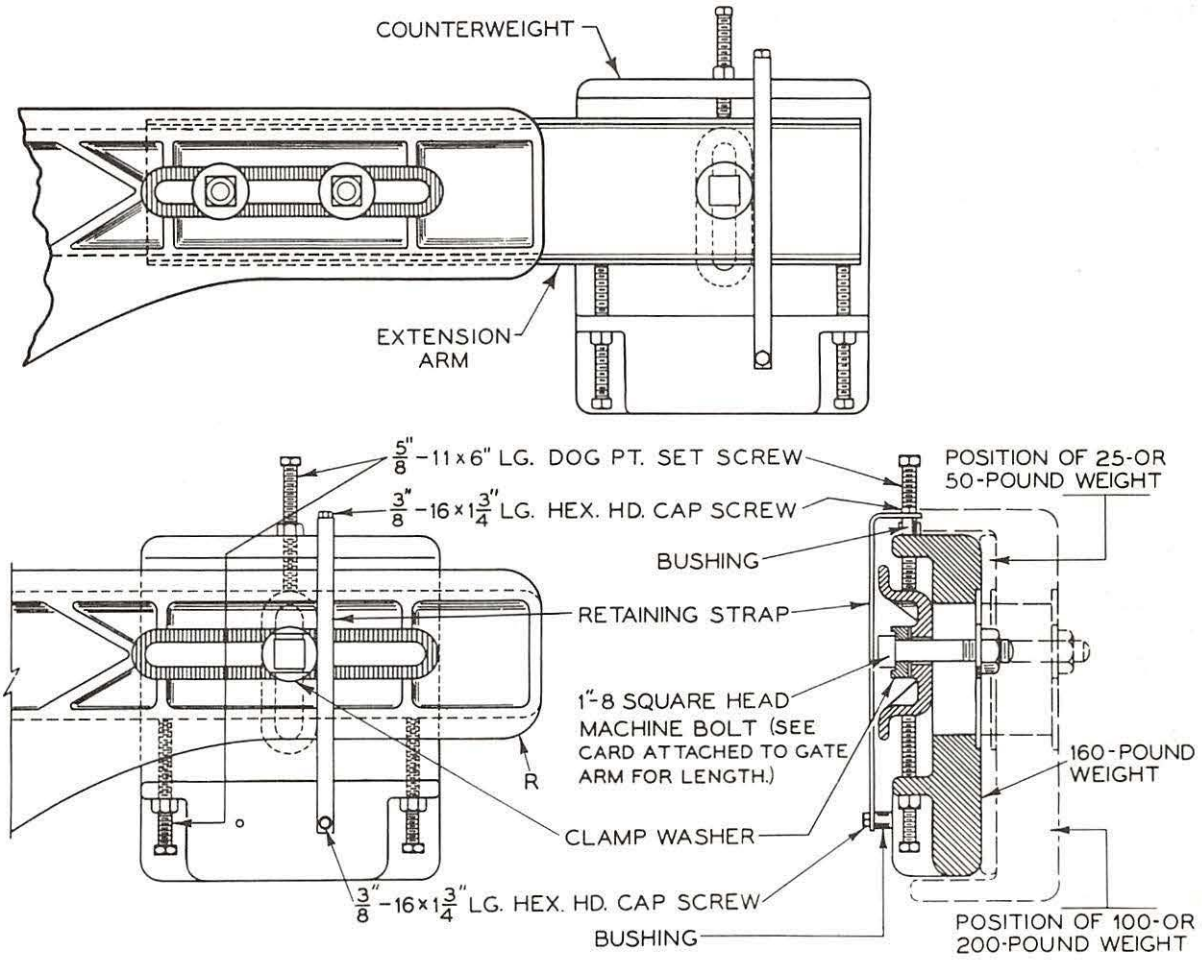

Figure 8. Method of attaching counterweights.

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To Adjust Horizontal Torque

Loosen nut on bolt B and slide weight C in or out until scale reads 10 pounds at 5'-0" from center line of shaft.

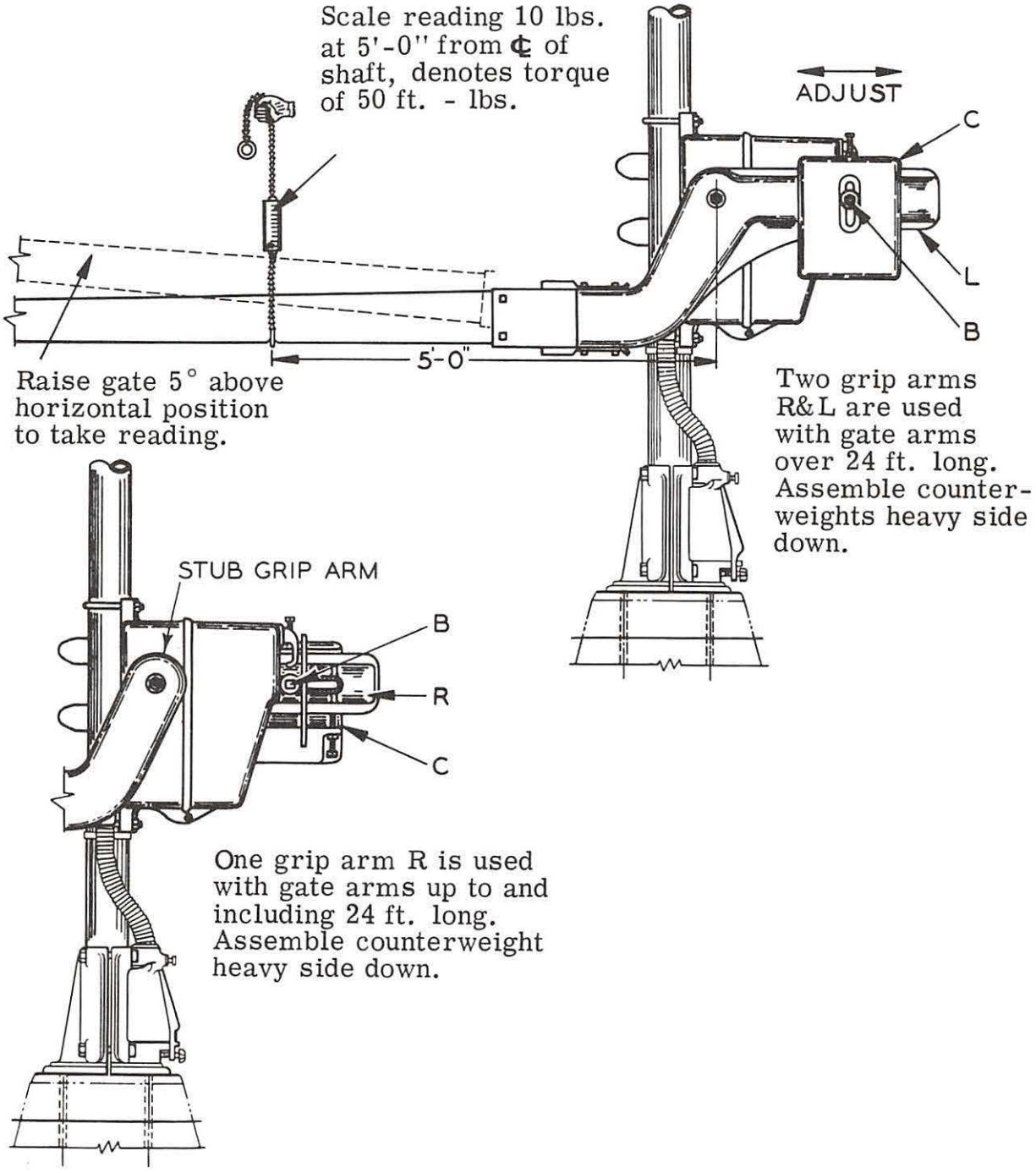
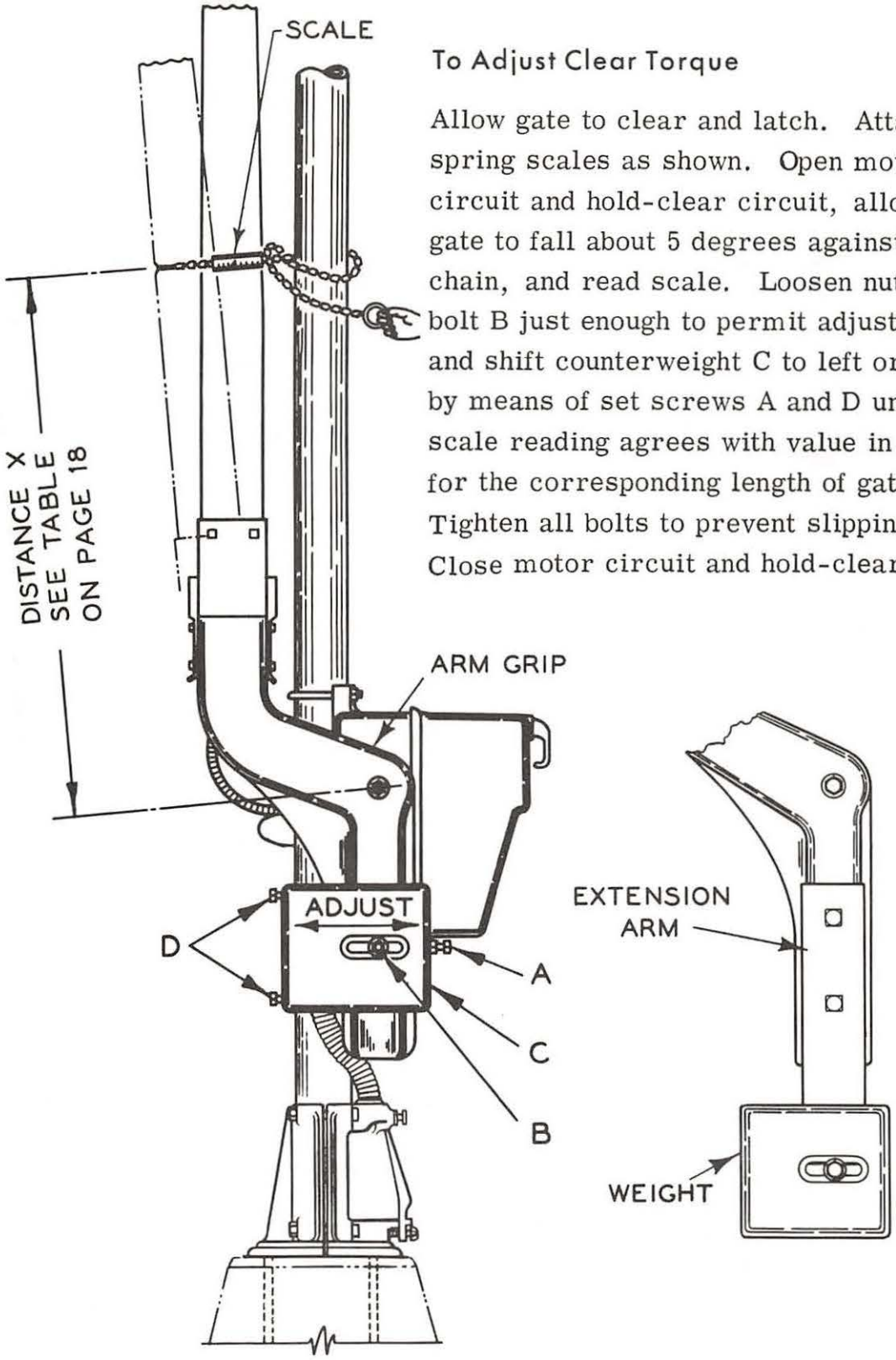

Scale reading 10 lbs. at 5'-0" from ℄ of shaft, denotes torque of 50 ft. - lbs.
ADJUST
C
L
B
5'-0"
Raise gate 5° above horizontal position to take reading.
Two grip arms R&L are used with gate arms over 24 ft. long. Assemble counter-weights heavy side down.
STUB GRIP ARM
B
R
C
One grip arm R is used with gate arms up to and including 24 ft. long. Assemble counterweight heavy side down.

Figure 9. How to adjust torque in horizontal position.



To Adjust Clear Torque

Allow gate to clear and latch. Attach spring scales as shown. Open motor circuit and hold-clear circuit, allowing gate to fall about 5 degrees against scale chain, and read scale. Loosen nut on bolt B just enough to permit adjustment and shift counterweight C to left or right by means of set screws A and D until scale reading agrees with value in table for the corresponding length of gate arm. Tighten all bolts to prevent slipping. Close motor circuit and hold-clear circuit.

Figure 10. How to adjust torque in clear position.

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Complete Table of Torque Values

	Gate Arm Length (Feet)	Gravity Torque in Clear Position* (Foot Lbs.)	Scale Reading (Lbs.)	Distance X Feet **	Approx. Lbs. of Counter-weight, Total†	No. of Cells (Lead Battery) ‡	No. of Cells (Nickel-Iron ‡ Battery)	No. of Cells (Nickel-Cadmium Battery)‡	Max. Amps. To Clear (under normal conditions)
Counterweighting on one arm only	14	200	40	5	160	6	9	9	7.1
	15	200	40	5	160	6	9	9	7.1
	16	200	40	5	185	6	9	9	7.1
	17	200	40	5	210	6	9	9	7.1
	18	200	40	5	235	6	9	9	7.1
	19	200	40	5	260	6	9	9	7.1
	20	200	40	5	260	6	9	9	7.1
	21	200	40	5	285	6	9	9	7.1
	22	200	40	5	285	6	9	9	7.1
	23	200	40	5	310	6	9	9	7.1
	24	200	40	5	360	6	9	9	7.1
	25	220	44	5	370	7	11	11	7.3
	26	240	48	5	395	7	11	11	7.5
	27	250	50	5	420	7	11	11	7.7
	28	266	38	7	470	7	11	11	7.9
	29	280	40	7	520	7	11	11	8.1
	30	301	43	7	620	7	11	11	8.3
Add extension arms	31	308	44	7	395	7	11	11	8.5
	32	315	45	7	420	7	11	11	8.7
	33	343	49	7	445	7	11	11	8.9
	34	369	41	9	470	7	11	11	9.4
	35	387	43	9	495	7	11	11	9.9
	36	405	45	9	520	7	11	11	10.4
	37	432	48	9	545	8	12	12	11.0
	38	450	50	9	570	8	12	12	11.4
	39	470	47	10	595	8	12	12	11.8
	40	480	48	10	620	8	12	12	12.2

* Where sidewalk arm is used, do not apply wood arm until torque adjustments have been made, as torque would be low if arm should be broken off.

** Distance X feet is the span in feet measured parallel to the gate arm from the pivot point of the arm grips to the point at which the spring scales are attached for measuring the clear or gravity torque.

† Will vary somewhat with weight of wood arm and lights. Extensions on counterweight arms of gates 31 to 40 feet long reduce the weight required.

‡ Assuming circuit between battery and motor has no more than 1/10 ohm resistance.

Wire Size

Size of wire used for the motor circuit should be selected so there is not more than 0.1 ohm between battery and mechanism terminals.

The following wire sizes are recommended:

Distance between Battery and Mechanism Terminals	Soft Drawn Copper Wire
Up to 60 feet (120 feet of wire)	No. 9 AWG
From 60 to 120 feet (240 feet of wire)	No. 6 AWG

Battery

The following battery is recommended with the above wire for gates of various lengths:

Gate Arm Length (feet)	Clear Position Torque (foot-pounds)	Number of Cells		
		Lead Storage	Ni-Fe Storage	Ni-Cad Storage
Up to 24	200	6	9	9
25 to 36	220 to 405	7	11	11
37 to 40	432 to 480	8	12	12

Lubrication

Figure 3 shows cutaway views of the Type B mechanism with symbols indicating proper lubrication for each point. Lubrication for the motor is shown in Figure 4.

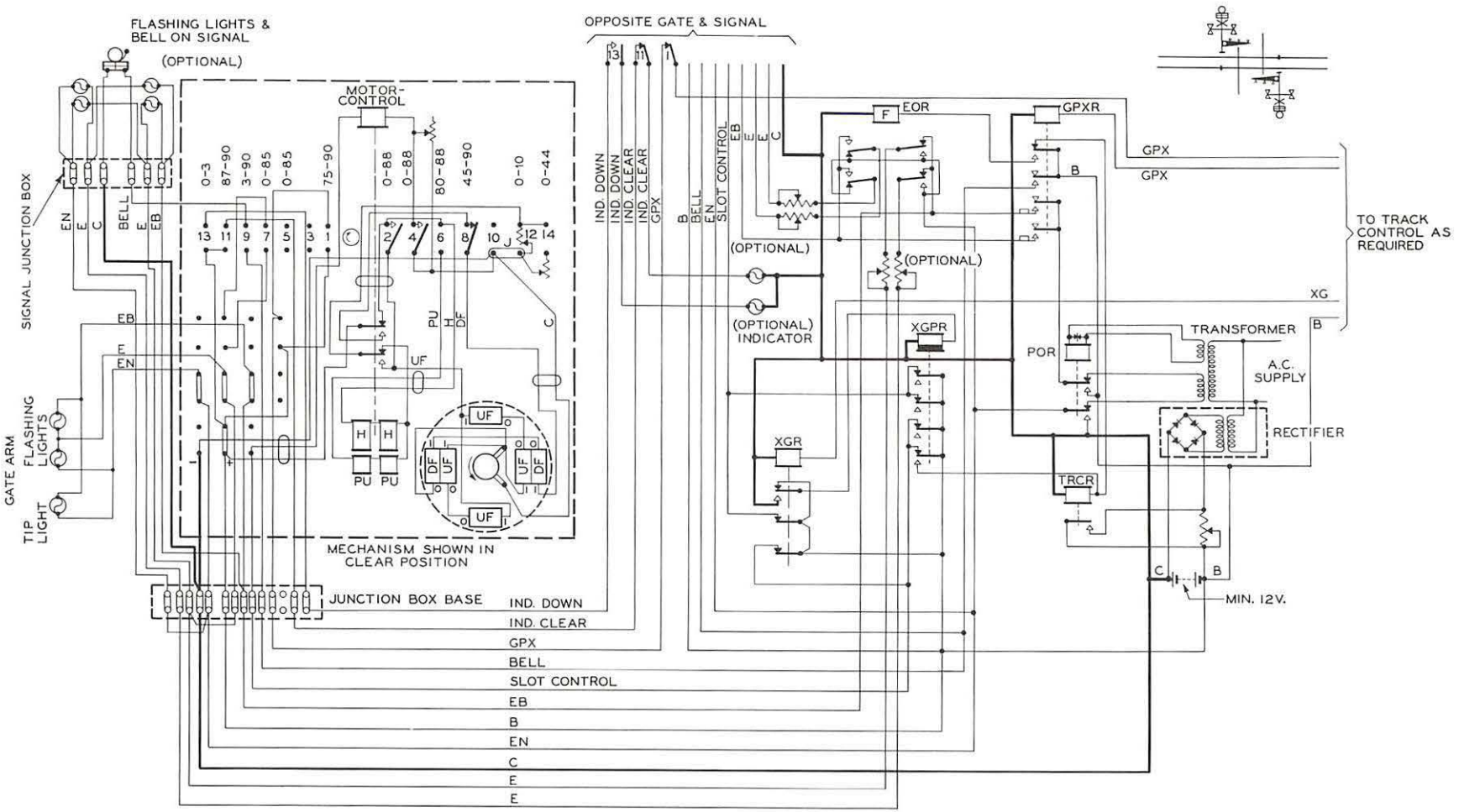


Figure 11. Detailed wiring for typical installation.

PROCEDURE FOR INSTALLING TYPE B MECHANISM

See the location plans on pages 26, 27, and 28.

Operations should be performed in the following order:

1. Install base and mast, making sure that junction box half of base and opening in mast for flashing light signal junction box (on cross arm) are in proper position with relation to the roadway, as shown in Figure 7. Knock out tin plug from wire outlet in top of junction box, remove conduit adapter from inside junction box and attach it to top of box with cap screws.
2. Clamp the Type B mechanism to the mast on the side away from the roadway so that shaft G is 4 feet 4 inches above the top of the foundation. The shaft should then be 4 feet 10 inches above the crown of the street to bring the gate arm to the proper height. The distance from the centerline of shaft G to the underside of the grip arm (arm in horizontal position) at the point where the wood gate arm is attached is 1 foot 8 inches.
3. Locate and drill 1/2-inch diameter hole in mast for pin on clamp. See Figure 3. Assemble clamp on mast and tighten securely. Mechanism may now be loosened on the mast enough to swing it around 90 degrees so gate arm can be installed without blocking vehicular traffic on the crossing.
4. Make sure gate arm shaft G is in the position it assumes when the gate arm is horizontal. This condition exits when gear segment E, Figure 6, is in contact with stop screw A.
5. Remove nuts, washers, and spline protectors, Figure 3, from ends of gate arm shaft.
6. If sidewalk arm is used, the mechanism is supplied with an additional shaft which has a square section extension on one side only of the mechanism case, see Figure 7. The shaft is installed to extend from the right (track) side of the case but may easily be changed in the field to extend from the left side of the case, should conditions require. Sidewalk arm support casting should be applied before grip arm R or L.
7. Apply grip arms R and L, Figure 7, keeping the gate end in the horizontal position when applying to shaft. Replace washers, lock washers

and nuts on ends of gate arm shaft G but DO NOT TIGHTEN THE NUTS.

8. Apply sheet steel gate support S, Figure 7, between arms R and L, insert bolts, apply lock washers and hex nuts, then tighten securely. Bolts for gate support S are square head machine bolts, 1/2" - 13 x 1 3/4" long.
9. Now tighten nuts on end of gate arm shaft G, Figure 7.
10. Slide gate arm into the channels of support S, insert bolts, apply washer plates on inner sides of wood sideboards (of gate arm) and install lock washers and nuts, tightening securely. Do not apply wood sidewalk arm until torque has been adjusted, see Figures 9 and 10.
11. The sidewalk arm should be applied in a horizontal position corresponding with the position of the roadway arm. Proper alignment is attained by loosening driving clamp in Figure 3, and adjusting the arm to the true horizontal.
12. Install gate arm lamp terminal blocks (which will be found in a carton secured to the inner side of the arm at one of the cross braces) at locations marked on trackside of arm, using flat head wood screws furnished, and attach wires from cable on gate arm to binding posts of terminal blocks.
13. Install gate arm lamps, using bolts furnished in holes already drilled, and attach lead wires to binding posts of terminal blocks, leaving the proper drip loop. Apply cover of terminal block with slotted wire opening facing mechanism end of arm so block will drain with gate arm clear. Remove tin plug from wire entrance opening in back of case and insert 90° squeeze connector, Figure 3, in tapped hole. Insert wires, extending from flexible metallic conduit on gate arm, through squeeze connector. Secure conduit in connector and attach wires to binding posts inside mechanism case as shown in Figure 11. If sidewalk arm lamp is used, remove 1/2-inch pipe plug from side of mechanism case near sidewalk arm shaft bearing, Figure 3, and install 1/2-inch street-el with strain relief bushing. Insert two-conductor cord through rubber bushing and pull enough inside the case to reach binding posts. Tighten strain relief bushing. Connect wires to same binding posts used for tip lamp on roadway arm.

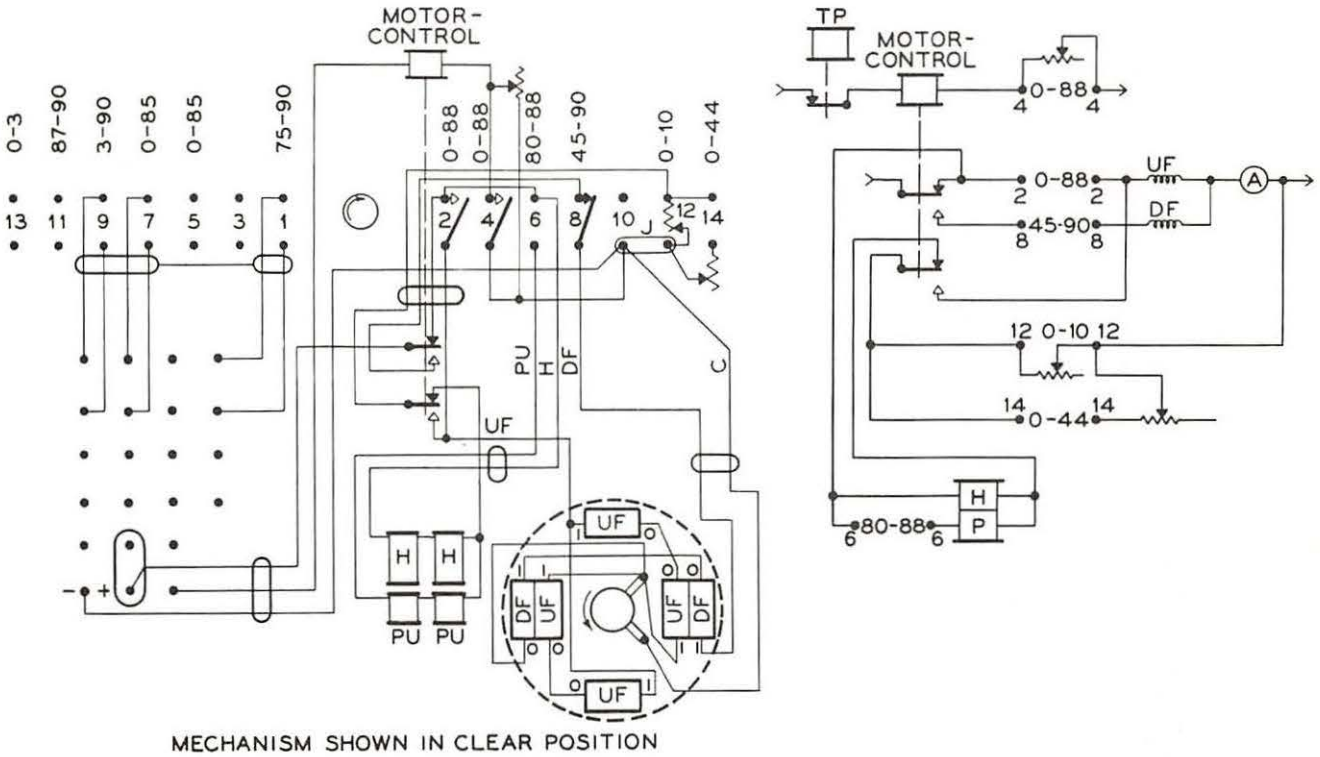


Figure 12. Typical circuits.

14. Attach counterweights as follows:

Counterweight and torque requirements for each gate arm are indicated on a tag attached to inside of each arm near mechanism end. See also complete table of torque values, page 18. For safety, have man hold gate arm in horizontal position while applying counterweights.

Where gate arms are not more than 24 feet long, only one grip arm R (Figures 7 and 9) is used. The stub grip arm L has no provision for mounting a counterweight. Where gate arms are 25 to 30 feet long, counterweights on both arms are required. If gate arm is 31 to 40 feet long, an extension for bolting on each grip arm is required. Counterweights are then bolted to these extensions in the same way they were fastened to the grip arms.

a. If gate arm is 24 feet long or less, assemble retaining strap to 160-pound counterweight as shown in Figure 8 for attaching to grip arm R, Figure 9.

b. If gate arm is 25 to 30 feet in length, assemble retaining strap to one 160-pound weight for attaching to grip arm R. Assemble retaining strap to the other weight for attaching to grip arm L.

c. If gate arm is 31 to 40 feet long, assemble retaining straps as in (b) above, except attach the counterweights to the extensions of grip arms R and L.

d. Place 160-pound weight or weights in position with heavy side down, and slide near the middle of the slot, Figure 8.

e. Insert clamp washer and 1-inch bolt, Figure 8. If additional weights are used, assemble as shown by dotted lines.

f. Apply washer and nut, but tighten only lightly.

15. If the preceding operations have been carried on with the crossing gate swung parallel to the highway (for convenience) the gate and mechanism should now be returned to the normal position they will occupy when protecting the crossing. As soon as this position is determined, the mechanism may be securely locked from turning on the mast by drilling a 19/32-inch hole in the mast to admit the pivot point of the 3/4-inch set screw, Figure 3, provided in the top clamp of the mechanism. Finally, remove or cut out weatherproof closure in conduit outlet on back of case and install 2-inch flexible metallic conduit.

16. Where sidewalk arm is used, make torque adjustments before applying wood sidewalk arm. For procedure, see Figures 9 and 10.

NOTE: For your convenience, a notch is cut in the under edge of one of the wood sideboards of each gate arm. This notch is 5 feet horizontally from the center of the shaft, and its location is indicated by an arrow on a card attached to the inside of the gate arm.

17. Check adjustment of 0° spring stop. See Stops, page 12.

18. Check adjustment of 90° spring stop. See Stops, page 12.

19. Adjust clear position torque. See Figure 10.

20. Check adjustment of motor cutout. See page 11.

21. Adjust descending time. See page 11.

22. Check the clearing time. See page 12.

23. Check the voltage across the coils of the motor-control relay. See page 8.

24. Before placing the mechanism in service:

a. Remove the metal strap which held the motor-control relay during shipment. Remove the cardboard protectors alongside the relay.

b. Wipe the hold-clear armature and pole faces with a clean, dry cloth to ensure that they are free of all dirt, oil, or grease which might later cause them to stick.

c. Check that all of the gears are lubricated. The gears in a new mechanism are factory lubricated and grease is applied to gear teeth.

d. Remove the tin plugs from the one-inch pipe-tapped holes in the back of the housing. Install the one-inch screened street-el ventilators, Figure 3.

25. Install crossarm and flashing light units, Figure 7.

26. Attach crossbuck sign. Attach the extension brackets to the adapter clamps on the back of the signs by means of the 1/2" - 13 x 4" long hex head machine bolts and nuts furnished with the extension brackets, and attach brackets to mast with U-bolts furnished with the signs .

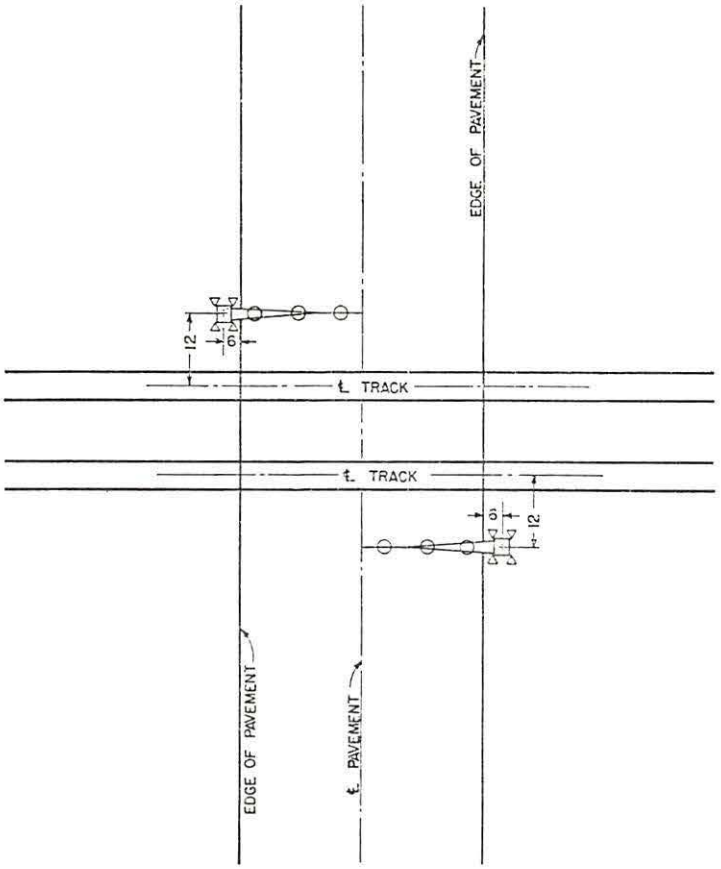
27. Place bell or pinnacle on mast. A bell, if used, should be placed with the gong parallel with the roadway; the sound thrown out by the edge of the gong is thus strongest toward oncoming vehicular traffic. Bell is shown correctly mounted in Figure 7.

28. Where channel extensions are furnished for arm grips, as shown in Figures 7 and 10, install extensions on the outside of the arm grip with bolt heads on the outside, nuts and washers on the inside toward the mechanism. With gate arms in the vertical or clear position, slide the extension to the lower end of the slot as far as it will go and tighten nuts securely. The correct counterweight may then be attached to the extension and positioned as shown in Figure 8.

GRS DEVELOPMENT SHEET

Association of American Railroads
Signal Section

Official Approval
Apr. 1954, Apr. 1960.



NOTE: PLAN MAY BE VARIED AS CONDITIONS REQUIRE.
ALL DIMENSIONS SHOWN IN FEET

TYPICAL LOCATION PLAN FOR AUTOMATIC GATES AND FLASHING LIGHT SIGNALS

RIGHT ANGLE CROSSING

AAR SIG. SEC. 17308

M-1959 OCT. 1959 M-1953 SEP. 1953

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TYPE B CROSSING GATE MECHANISM

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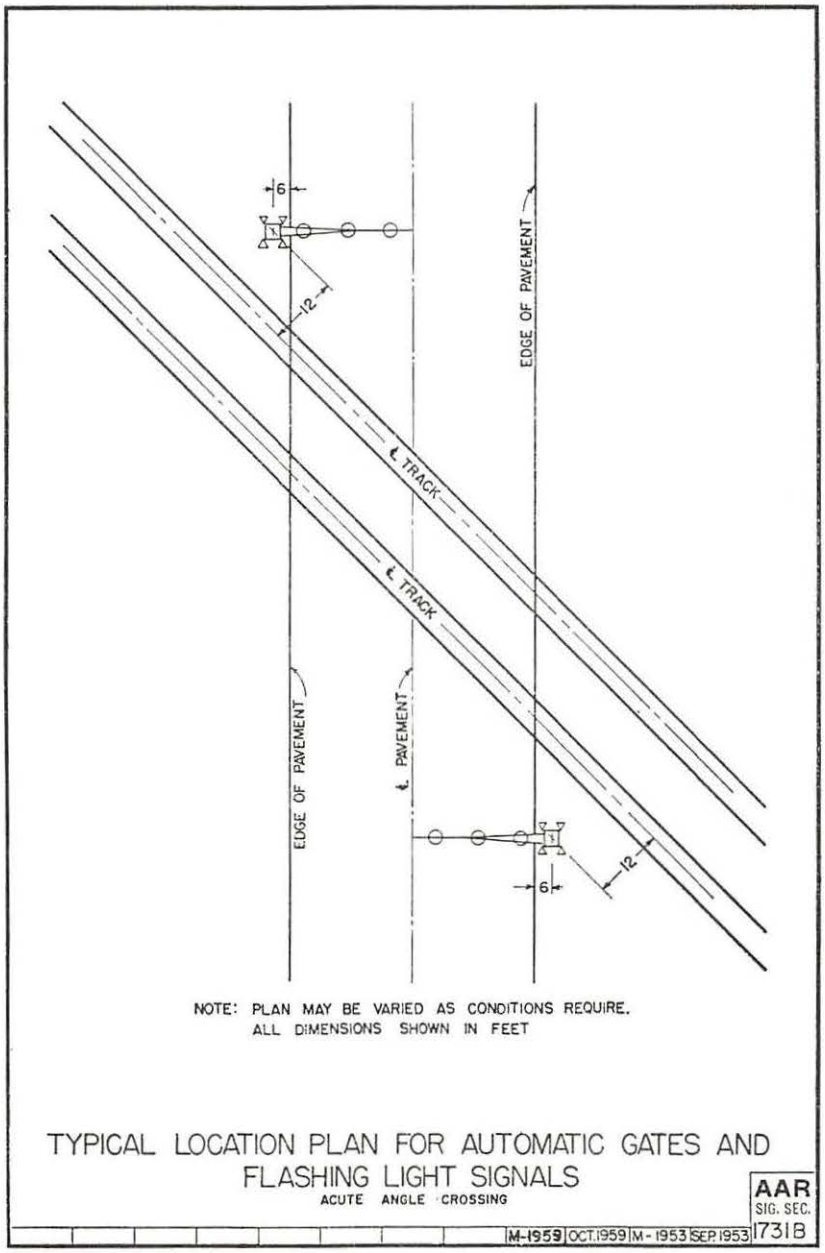

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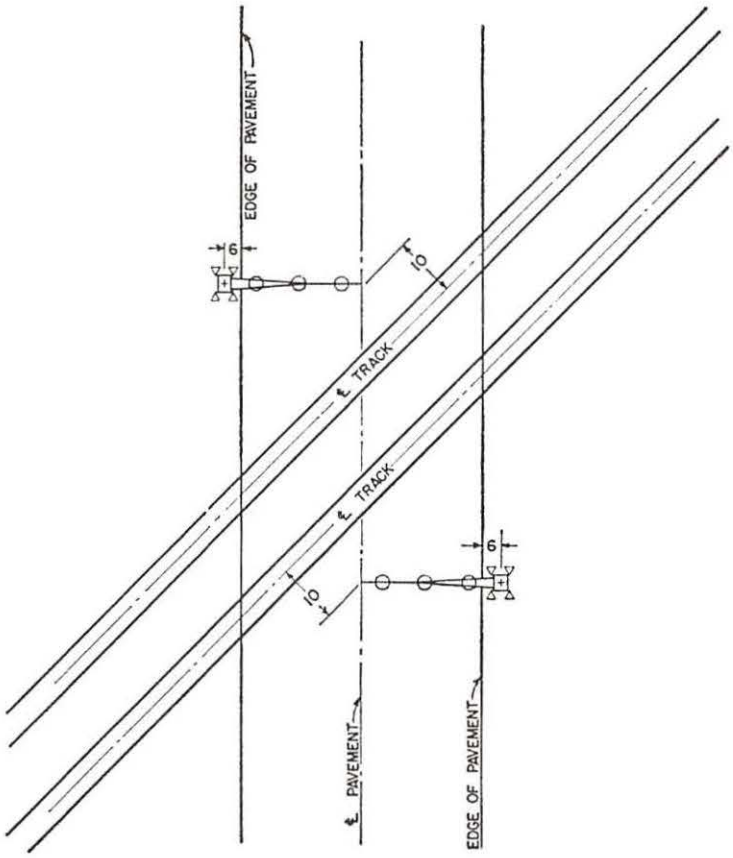

NOTE: PLAN MAY BE VARIED AS CONDITIONS REQUIRE.
ALL DIMENSIONS SHOWN IN FEET

TYPICAL LOCATION PLAN FOR AUTOMATIC GATES AND FLASHING LIGHT SIGNALS
OBTUSE ANGLE CROSSING

AAR SIG. SEC.

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